

# 1 Introduction

## A Dynamic Business With Taste – The Flavour Industry

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Humans are decisively influenced by their sense of taste and odour and human history is, therefore, closely tied to the development and usage of flavours. Whereas in prehistoric times, only herbs and spices could be employed for flavouring purposes, today a broad spectrum of flavourings is available, not only for use in the individual household, but especially for the production of food on an industrial scale.

The application of all products from the flavour and fragrance industry is solely aimed at enhancing the human striving for increased pleasure and sensual enjoyment. Hedonistic aspects, therefore, form the basis of our industry [1].

The roots of this industry date back to early Egyptian history, as this extraordinarily advanced civilisation was already thoroughly aware of and acquainted with perfumery and the embalming characteristics of certain spices and resins. Simple methods for the distillation and extraction of essential oils and resins were already known in pre-Christian times and subsequently elaborated by the Arabs. Balsamic oils produced by these methods were later on primarily used for pharmaceutical purposes; it was not before the times of the courtly baroque period that fragrance was an aspect of growing importance. In the medieval age, mostly monks were the pioneers in the art of capturing natural essences and transforming them into substances capable of flavouring food [2].

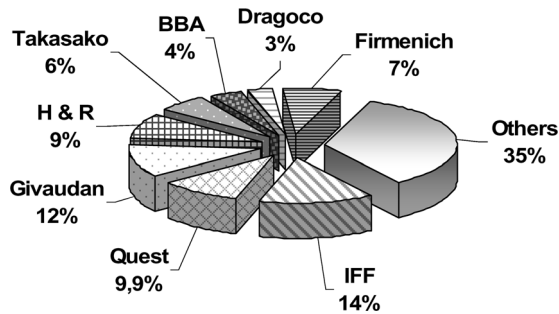
The onset of the industrial production of essential oils can be dated back to the first half of the 19<sup>th</sup> century. After the importance of single aroma chemicals was recognised in the middle of the century, efforts were started to isolate such compounds from corresponding natural resources for the first time. This was soon followed by the synthesis of aroma chemicals. In this context, the most important pioneers of synthetic aroma chemicals have to be mentioned, such as methyl salicylate [1843]\*, cinnamon aldehyde [1856]\*, benzyl aldehyde [1863]\* and vanillin [1872]\*, as they constitute the precursors of a rapidly growing number of synthetically produced (nature-identical) aroma chemicals in the ensuing years.

From this starting point, the flavour and fragrance industry first developed in Europe, expanded to the USA and later reached an international scope. Today Western European companies have reconquered the leadership position in this market, which, after the 2<sup>nd</sup> World War, was held by American companies.

Generally, the dynamics of the flavour and fragrance industry mirror the trend of many industrial sectors: the most important representatives of a large number of nationally oriented companies have through mergers, acquisitions and market expansion developed into globally operating multinational enterprises. As a result of this

\* year of the first synthesis

concentration process, the number of small and medium-size businesses decreased, a trend that will certainly result in a more uniform, less diverse market. Already an analysis of the year 1995 showed that approximately 65% of the total turnover of the flavour and fragrance industry is achieved by fewer than 10 firms (Fig. 1.1).



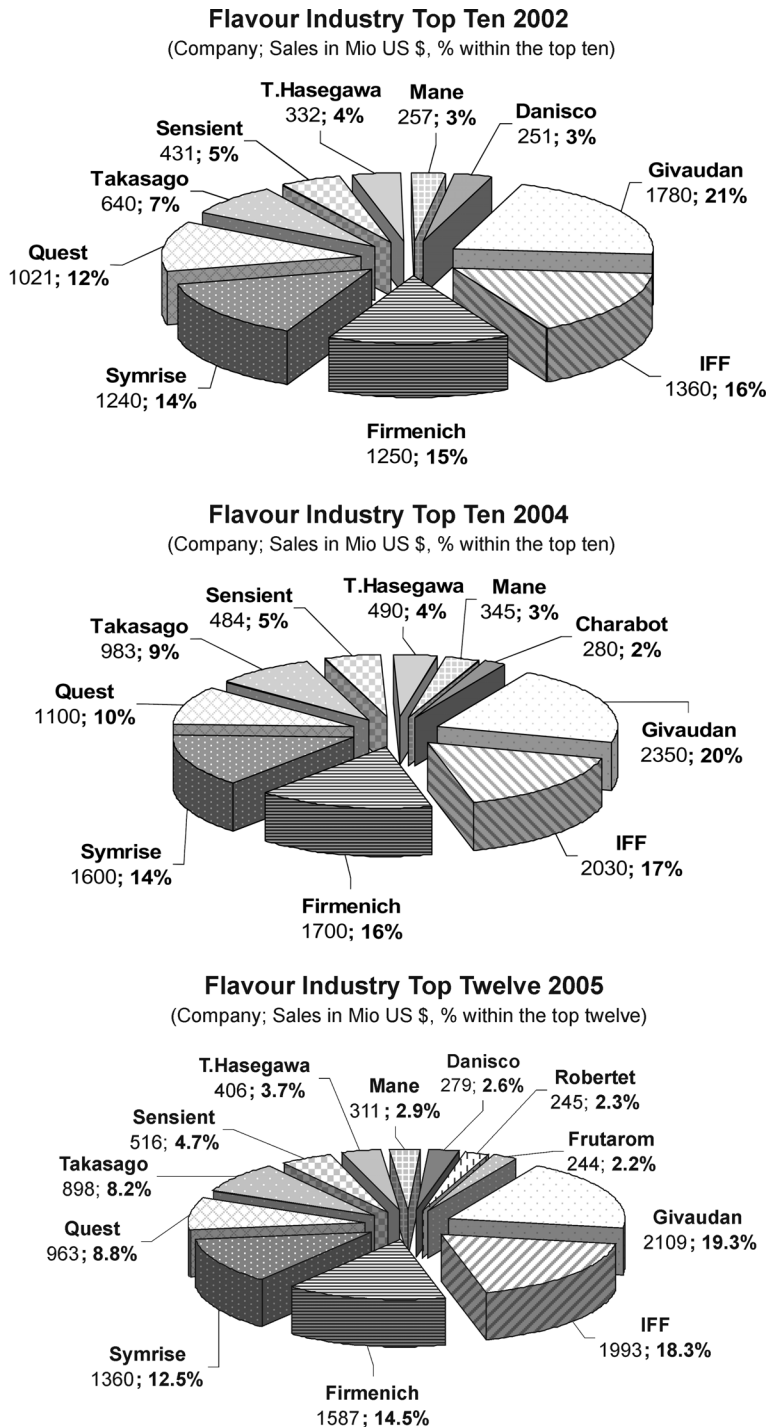
*Fig. 1.1: Competitors' share of world market (1995) in aroma chemicals, fragrances and flavours (estimated by Haarmann & Reimer) [3]*

Also, today analysts estimate the market share of the 'Top Ten' flavour houses at approximately 65% of the entire world market. The preceding decade, often described as the 'Age of Acquisitions', has for the Top Ten of the flavour and fragrance industry resulted in the current market shares depicted in Fig. 1.2.

Givaudan, IFF, Firmenich and Symrise are the contestants for the leadership positions, followed by Quest and Takasago in centre field, while Sensient, Hasegawa, Mane, Charabot and Danisco, with rather similar market share, compete every year to join the higher ranks of the Top Ten. However, it is of considerable importance in this context on which data the respective analysts base their evaluation. Therefore, in the data employed for 2005 [5], sales of non-flavour and fragrance industry items, included by some flavour and fragrance houses in their sales totals, have been subtracted or eliminated from the total sale figures (items eliminated include materials such as sugar, sunscreen chemicals, chemical intermediates, pharmaceutical chemicals, stabilisers, gums, etc.).

Comparison of the sales figures for the years 1995 and 2005 clearly reflect the ongoing changes in the corporate landscape. The merger of the two German flavour giants Haarmann & Reimer and Dragoco to form Symrise has strengthened the company's position in the top ranks. Names that are deeply rooted in and intertwined with the traditions and outstanding developments of the flavour and fragrance industry – such as the vanillin synthesis and the name Haarmann & Reimer (founded 1870) – today remain without contemporary counterpart. Analogously, with IFF's acquisition of Bush Boake & Allen in 2001, the name BBA, considered an invariable constant in Britain, ceased to exist. The pending merger of Givaudan with Quest in November 2006 marks another step towards further market consolidation. Givaudan's current unrivalled market leadership will certainly be source and aim of other interesting developments in the industry.

The landscape of the big players of the flavour business is still centred on companies with European roots, which, however, all constitute global players.

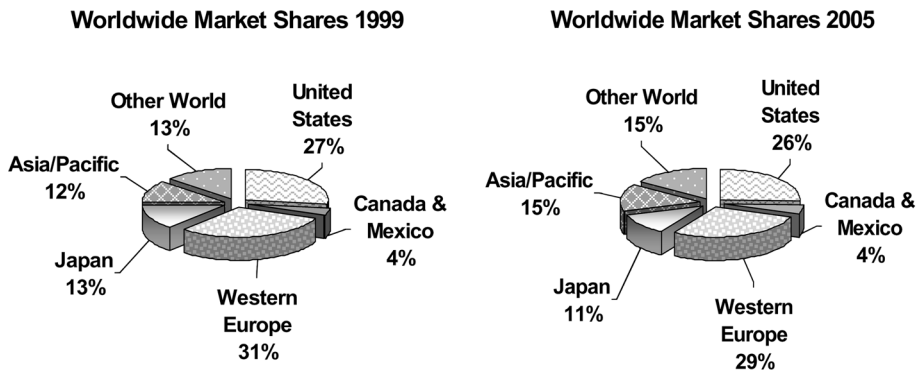


*Fig. 1.2: Competitors' share of world market (2002, 2004 and 2005) in aroma chemicals, fragrances and flavours (calculated by www.leffingwell.com [4])*

These companies are closely followed by a considerable number of international and national manufacturers (not resellers) of flavours and fragrances with sales figures which are sometimes only slightly lower, but often not published as a result of private ownership. Danisco, Ungerer & Co., Robertet, Bell, Shiono, Chr. Hansen, Frutarom, Wild, McCormick, Treatt, Todd and Mastertaste (Kerry) deserve mentioning as examples of a long list of flavour and fragrance companies [4, 5].

These manufacturers are countered by the big purchasing companies, the multinational giants of the food and beverage industry as well as the household and consumer goods sector (Procter & Gamble, Unilever, Nestle, Kraft, Coca-Cola, Pepsi, General Mills, Danone, etc.).

In this context, an analysis of the flavour and fragrance sector along geographic regions and national boundaries is of considerable interest. As a single nation, the USA continues to be the world's largest consumer of flavour and fragrance products [6]. Together with Europe and Japan, the USA accounts for only 15% of the world population, but made up 71% of the overall demand for flavours and fragrances in the year 1999 and 66% in 2004 [[www.leffingwell.com](http://www.leffingwell.com)]. This clearly reflects the trend of increasing industrialisation usually coupled with a growing demand for flavours and fragrances in other parts of the world, especially Asia. The magical 'A' of Asia has to be granted as much importance in this context as the 'A' of acquisitions, as both 'A-words' decisively influence the investment trends of the flavour and fragrance industry in the beginning 21<sup>st</sup> century.



**Fig. 1.3:** Worldwide market shares of the flavour industry for the years 1999 and 2005 (estimated by Freedonia; see: [www.leffingwell.com/1372pr.pdf](http://www.leffingwell.com/1372pr.pdf))

The total market, valued at US\$ 9.6 billion in 1995, has nearly doubled in the ensuing decade. The share of the typical flavour sector with its classic division into beverages, sweets, dairy and savoury, can only be estimated today and is usually valued at slightly over 40% of the total sales volume. Generally speaking, the global share of the flavour industry on the one hand and the fragrance industry on the other hand can be best approached with an approximate 50:50 ratio.

Since the 1960s both the usage of flavours and fragrances and their general acceptance in a broad array of consumer goods has been continually on the rise. This development in combination with the growing industrialisation in a number of coun-

tries and, as a consequence, the predilection for flavours and fragrances does indeed portend well for the flavour and fragrance sector. This industry can realistically look forward to positive expectations and increasing turnover in the future. As far as fragrances are concerned, David J. Rowe has remarked with pleasant cynicism: ‘This trend might perhaps suggest we have become afraid of smelling human’ [7].

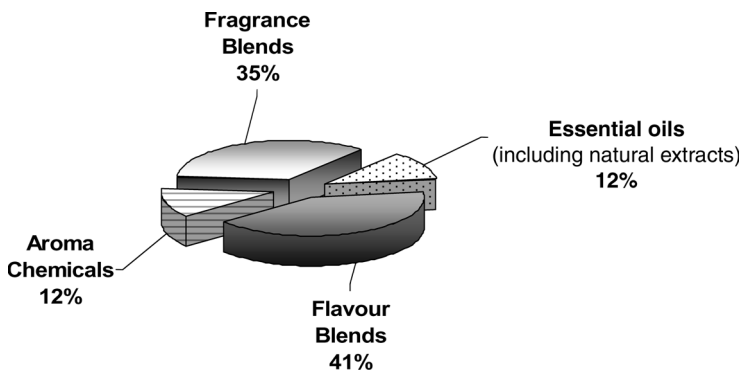
### The Flavour and Fragrance Industry – Sectors and Materials

Basically, three main subdivisions can be distinguished [6]:

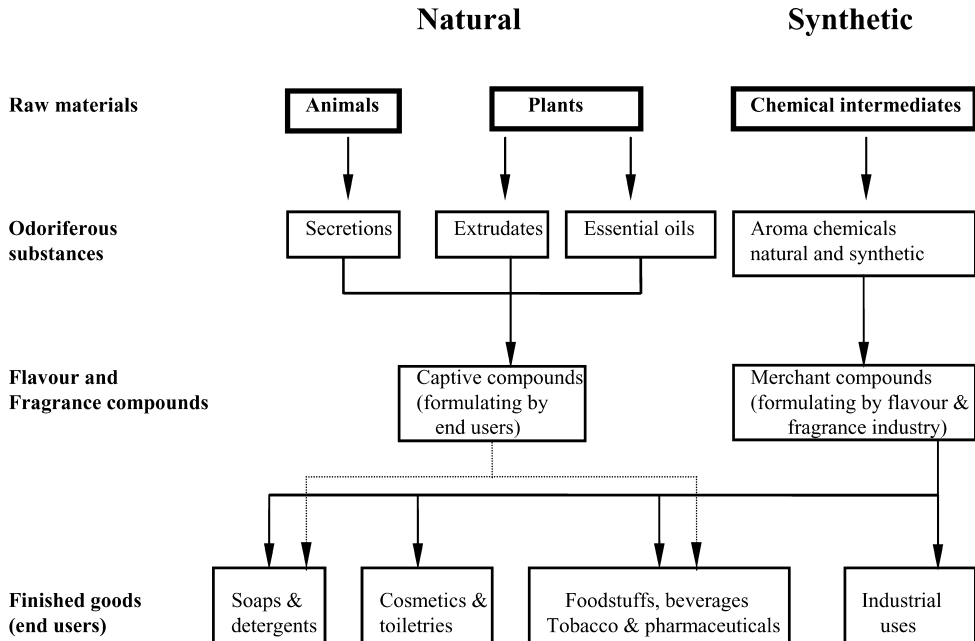
- essential oils and natural extracts
- aroma chemicals
- formulated flavours and fragrances.

While *essential oils* and *natural extracts*, which are obtained from natural resources by various processes, mainly constitute complex mixtures, *aroma chemicals* are uniform compounds, which can be both of natural or synthetic origin. A number of representatives of frequently used *aroma chemicals* show an enormous discrepancy between synthetic and natural material. Raspberry ketone shall be used as an example here: for the year 1992, an estimated yearly worldwide consumption of 400 kg of natural material is countered by the 300-fold amount of synthetic material which found industrial usage [8].

*Formulated flavours and fragrances* are complex blends of aromatic materials such as essential oils, aroma chemicals and natural extracts. Depending on their intended usage and the type of flavour release envisioned by product design, they are available in concentrated form, diluted in solvents or bound to carriers.



**Fig. 1.4:** Market share of the individual sectors of the flavour and fragrance industry (2002, estimated by Freedonia Group, C&EN estimates)



*Fig. 1.5: Industrial usage of flavour and fragrance materials [9]*

### The Flavour and Fragrance Industry – Trends, Expectations, Functionality

The demand for food flavourings has been constantly growing over the last 100 years as a result of the dramatic changes caused by our increasingly industrialised life-style. The shift of food production from the individual household to craftsmen and on to the food industry was accompanied by an increasing need for flavours.

Whereas earlier, technologically caused flavour losses were often the reason for the addition of flavourings, improved technology did not lead to a reduced demand for flavourings. This is a result of changed consumer expectations that went hand in hand with improved standard of living and changed life-styles and philosophy of life [1]. Today this trend can again be observed in new industrially developing countries.

In the 1950s and 1960s, consumers welcomed technological advances and were fascinated by and had a positive attitude towards progress. Better tasting, strongly flavoured food was just as acceptable as new convenience products, which often still required compromises in taste. The acceptance of synthetic materials was all-embracing; this was also the case in the flavour sector.

In the following decades, consumer attitudes changed dramatically: food and its quality evolved into a symbol of personality, expressed by the slogan ‘you are what you eat’. Health, fitness and diet became the precursors of all current trends up to the turn of the century. Today, especially wellness, well-being and a well-balanced life-style have to be added. The fortification with vitamins and minerals results in products that implicate pharmacological benefits, a trend which is increasingly called for by consumers.

Demographics, therefore, play an increasingly important role in today's flavour industry [10].

The informed chemophobic consumer of the multi-media age of the 1990s was already rather demanding [10, 11]:

- natural, pure, whole
- freshness
- vegetarian products
- ethnic foods
- high fibre content
- high vitamin content
- low calories
- low fat
- low cholesterol
- low caffeine
- low nicotine

All these attributes and a number of others continue to characterise the current food trends. Additionally, **health, wellness, variety** and **anti-aging** are the major driving forces of today's **functional foods**. Never before has the consumer been so sensitive to the correlation between health consciousness, diet and long life, nutrition and fortification with a simultaneous acceptance and growing consumption of better tasting, ready-to-use convenience foods [12, 13].

While the unbroken strength of the focus on 'all natural, food-minus (especially low-fat) and food-plus' continues, we have to add the following aspects which drive our consumer trends today:

- healthy
- low sugar, low carbohydrate, low glycemic (with all aspects of the glycemic index (GI), and GI reference labelling)
- low sodium
- fortification with minerals (calcium on top) and vitamins
- functional
- wholegrain
- organic
- no additives and no preservatives – a very strong recent trend resulting from the discussions on allergies and intolerances
- gluten free
- portion control as an aspect of diet and daily requirements.

The results of all current trends are more and more convenient products which combine many of the actual tendencies (e.g. new soups classified as 'all natural, high fibre, wholegrain, cholesterol and additive-free, fortified with minerals') in products which possess a good window of opportunity for fast and successful market entry. Supported by skilful and clever sales promotion, it is suggested to consumers, especially the youngest ones, that 'it's cool to eat healthy'.

The aspects mentioned above certainly constitute important trends on a worldwide basis; however, it has to be taken into account that the individual trends are valued differently, depending on culture and geographic region. The evaluation of 'Food-Minus' and 'Food-Plus' in the different regions of the world market is depicted as an example in Tables 1.1 and 1.2.

**Table 1.1:** Trends in 'Food-Minus' in different markets (2004) [14]

<b>Latin America</b>	1. low calorie	2. low fat	3. low sugar	4. no additives, no preservatives	5. no cholesterol
<b>North America</b>	1. low carbohydrate	2. low fat	3. no additives, no preservatives	4. low sugar	5. low calorie
<b>Asia/Pacific</b>	1. no additives, no preservatives	2. low fat	3. low sugar	4. low cholesterol	5. low calorie
<b>Europe</b>	1. low fat	2. no additives, no preservatives	3. low sugar	4. low calorie	5. low cholesterol

**Table 1.2:** Trends in 'Food-Plus' in different markets (2004) [14] \*

<b>Latin America</b>	1. Vit/Min* fortified	2. all natural	3. added fibre	4. wholegrain	5. added calcium
<b>North America</b>	1. all natural	2. organic	3. Vit/Min* fortified	4. vegetarian	5. add calcium
<b>Asia/Pacific</b>	1. Vit/Min* fortified	2. add calcium	3. all natural	4. vegetarian	5. functional
<b>Europe</b>	1. Vit/Min* fortified	2. vegetarian	3. organic	4. all natural	5. gluten free

Whereas the importance placed on the respective trend attributes varies considerably in different regions, the general tendencies are ubiquitous. Moreover, today's consumer focuses on an interesting, pleasurable, exiting or completely new taste experience. Within the flavour sectors, the developments for beverages took the lead in 2004 with 17% new introductions, followed by bakery products (12%), confectionery (11%), dairy (9%), sauces and seasonings (8%), snacks (8%), meals and meal centres (7%), processed fish, meat and egg products (6%), desserts and ice-creams (6%), side dishes (3%), fruits and vegetables (3%) [14].

\* Vitamins and minerals



The key categories of new flavour trends can be divided into three application directions:

- **Salty snacks** with mostly typical flavours (cheese, salt, chilli), hot and new flavours, which indicate potential growth segments (meaty flavours, ethnic flavours in new ways).
- **Juices** with orange being predominant (number one in all regions) or extremely fragmented flavour blends (orange plus other flavours (aloe vera, mango, hibiscus, vitamins fortified)).
- **Sugar confectionery** (strawberry on top in all regions) and regions with very specific flavours and generally a high geographic diversity (chocolate within the top ten of Asia, liquorice (Europe), tamarind (Latin America), sour (North America)).

Additionally, strong increases are predicted for ethnic offerings in meals. Seasonings remain spicy, new beverage flavours come from a variety of sources, and children's flavours continue to be popular.

A new trend is also to surprise consumers with flavours in unexpected categories (banana mayonnaise for children (Asia), or green tea cereals (Japan)); this trend is called *flavour migration*. 'Marrying of good flavour with nutrition' is also predicted.

Therefore, a balance of good taste combined with good nutrition, supplied in 'cool packaging' that appeals to children, seems to show the most effective way for product placement in the future. Additionally there seems to be a revival of comfort foods associated with 'nostalgia', which give the consumer the promise of basic security, familiar classics and casual lifestyle. Indulgence does play a considerable role in the sweets sector: to spoil oneself, easy-to-use small packaging units (e.g. drink desserts) and portion-controlled convenience mini meals which feature daily affordability, and possess considerable marketability [15].

The consumer's expectations towards natural, creative products with sensational effects increase, while the tolerance threshold for accepting expensive brands in the food sector decreases dramatically, especially in Western Europe. This trend is actually a leading one: price restrictions constitute a decisive criterion in each and every product development.

This constitutes a great challenge, not only for the food industry but especially for the flavour and ingredients industry.

### **The Flavour and Fragrance Industry – Challenges and Opportunities**

In the course of the last decade, this enormous challenge led to nearly revolutionary structural changes, especially in the technological sector. This was the only way to answer the trends towards natural systems, while simultaneously increasing cost effectiveness.

This resulted also in the transferral of biotechnological basic knowledge into large areas of industrial production processes [16]. Additionally, gentle, modern technologies, such as reverse osmosis, ultra-filtration, column chromatography and cold extraction processes, were increasingly employed to obtain stable, final products with

the utmost degree of naturalness – a driving force of the flavouring and fragrance industry.

Today broad analytical knowledge, the result of the rapid development in the analysis of different matrices, is, thanks to computer technology, omnipresent. From simple gas chromatography assistance up to the highly improved analytical technique of the electronic nose detector – as an example of a relatively new routine analytical approach – modern techniques are available for all areas of flavour creation, technological production and quality control. In the end, the composition of a flavour remains a creative act of art, despite the fact that today scientific knowledge of modern analytical methods is a prerequisite. Based on flavour science, the combination of flavour compositions and building blocks permits the creation of taste sensations tailored for the customer's delight. The recipes resulting from such compositions are today the last well-kept secrets of the flavour houses.

Moreover, it has to be mentioned that our industry was not spared from efforts to reduce costs via suppliers – the well-known 'Lopez Syndrome' of the 1990s [11]. As a consequence, the demands of the food industry on its ingredients and the respective suppliers intensified considerably.

This trend became increasingly demanding towards the turn of the century and culminated in the first decade of the 21<sup>st</sup> century. Commercialists that celebrate the coolness of greed have transferred this fixation on low price onto overall consumer attitude. However, the balance should not be lost here. As far as flavours are concerned, it should be kept in mind that as a percentage of the total product costs, flavour costs are usually rather low and it is often solely its flavour that accounts for victory or defeat of a product in the market place [17].

For this reason, product design oriented towards the 'Da Vinci Principle' is today considered as the most effective method for creating an innovative new product endowed with optimised properties for market acceptance and penetration. The utilisation of a balance between art, science, logic and imagination, known as the 'Da Vinci Principle' can be utilised in every step of product development to reach higher efficiency through this 'whole-brain' development approach [18].

The intelligent direct confluence of product development in flavour houses and application teams at the customer level constitutes another tool for achieving success and cost effectiveness [19].

The slogan *multifunctionality* [1] plays an important role in the 'flavours of the future'.

*Multifunctionality* with regard to the single components will simultaneously lead to simplified process technology and cost reductions and is, therefore, increasingly called for today [20]. A lactobacillus culture, which on the one hand imparts a positive mouthfeel effect to a beverage while producing natural stabilisers through its metabolism on the other hand, is just as good an example as thickening agents, which simultaneously have positive effects on stabilisation.

Cooling agents that simultaneously strengthen the flavour of a product should be mentioned in this context. The usage of a variety of different spices can, apart from

their flavouring properties, at the same time impart additional benefits to the product as far as preservation, colour and health are concerned. Especially for organically oriented consumers, such ingredients constitute a valued alternative to chemical preservatives and artificial colours [21].

The so-called *intelligent flavours* (flavours being liberated when food is prepared or when it is eaten, depending on different factors such as pH value and temperature) have been gaining increasing importance. These high-tech intelligent compounds give access to clearly defined product properties.

In this context, the potential of a number of diverse ingredients with significant potential as *flavour enhancers* or *masking agents* have to be mentioned. In particular, special minus-diets, e.g. low-carbohydrate or low-fat diets, change the taste, texture and sensory qualities of a product and therefore require corresponding alterations to endow the products with the properties called for by the consumer. Flavour enhancers are defined as: ‘natural substances which are components of proteins or cell tissue. They have no typical taste or smell, but their presence potentiates other flavours present in the food.’ In this field more and more studies are looking at the synergistic abilities of flavour-enhancing substances and the possibility of flavour masking.

Bitter blockers and sweetness potentiators are another field of current importance.

Additionally the new trend of ‘*kokumi*’ has to be mentioned in this context. Special flavours, which add the kokumi taste, are declared to be the ‘key to deliciousness’. The Japanese word *kokumi* apparently denotes ‘a mixture of different taste or mouth-feel characteristics, including impact, mouthfulness, mildness and taste continuity’ [22].

These research interests of the last decade are today partly available in the form of products and will certainly lead to further interesting developments.

The combination of scientific techniques such as genetic engineering, biotechnology, enzymology, physics and electronics will play an important role in the development of new, innovative flavours.

*Multifunctionality* with regard to the ingredients industry today means additional service, food innovations and product design, also from the flavour industry [11]. This part transferral of R&D costs from the food industry into the flavour and ingredient industry requires enormous additional efforts, but constitutes an extraordinary challenge with a high potential to guide the trends towards the favoured products of the flavour industry.

The possibility of gaining market shares for the flavour and fragrance industry by establishing new trend products or by expanding into areas which so far have remained ‘unflavoured’ constitute only the best known varieties of possible expansion prospects. As other examples from the beverage sector, the manifold new creations of flavoured coffees and ready-made milk drinks as well as the increasing demand for ice teas in Europe deserve mentioning [23]. Additionally, in the beverage sector new beverages borrow flavours from other categories (e.g. peppermint waters as well as brain-twist sensation drinks and ‘*think-drinks*’ with omega 3-fortification).

In particular, the product developments in the sector of the '*free from certified allergens*' products, which guarantee the absence of a group of allergens, are examples of sophisticated foods, which certainly possess growing market potential. This places a double challenge on the flavour industry, as, for example, a tomato-free ketchup certainly has a considerable need for a substantial amount of flavour. Similarly, food additives such as the category *fat replacer* necessarily lead to a higher demand for flavourings in these products, as the fat's loss of taste has to be compensated.

Potential for growth and new perspectives are, therefore, for the flavour and fragrance industry mainly a question of imagination and ingenuity, market observation and skilful marketing. Opportunities abound.

*'Change is occurring in our industries at an ever faster pace. Fast progress is both exhilarating and painful, but the rewards for the company which thrives on the opportunities presented by change are often associated with an accelerated progress towards industry leadership' [20].*

Additionally, the expansion into emerging markets on an international level plays a fundamental role in this context, as saturated markets, such as the USA, only promise trend shifts with small growth rates. The improved standard of living in Eastern Europe and Asia continues to promise an enormous potential of new consumers, which decisively contributes to improved turnover and positive future perspectives [11].

A look at the figures of new introductions in the beverage sector confirms the actual increase in the number of newly introduced products in the years between 2002 and 2004 at an annual worldwide average rate of 20%. In certain regions, such as Latin America, it is not uncommon that the number of innovative products is double that of the preceding year [24].

The constantly falling barriers between cultures, which, sparked by ever increasing mass tourism, led to a boom in ethnic foods in Europe and America, now increasingly expected for developing countries.

Decisive political factors such as the creation of free trade zones with single currencies and shared legislative guidelines offer promising prospects also for the flavour industry with its pronounced orientation towards further globalisation [16].

Within the scope of this book, this glimpse at the dynamic network between the flavour and fragrance industry and the sophisticated consumer of the 21<sup>st</sup> century illustrates the interesting perspectives for the future of the business with taste. Increasing client demands on flexibility and service will be countered by the flavour industry with improved customer support and by providing complete solutions ranging from 'concept-to-market' to 'creating brands'.

Today the leading flavour companies declare themselves as 'customer-focused and technology-driven' [17].

In the future an all-embracing understanding of 'sensory intelligence, sensory creation, sensory technology and sensory science' will contribute to the success of the flavour and fragrance industry. '*Sensory expertise reveals today how much is still to discover and innovate in our industry*' [25].

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